



650V Super-Junction Power MOSFET

DESCRIPTION

650V super-junction Power MOSFET

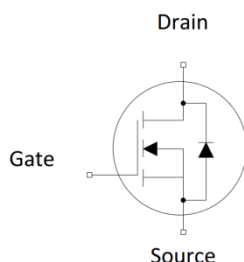
Super-junction power MOSFET is a revolutionary technology for high voltage power MOSFETs, designed according to the SJ principle. The SJ MOSFET is a price-performance optimized product enabling to target cost sensitive applications in Consumer and Lighting markets, designed by Wuxi Unigroup Microelectronics Company.

FEATURES

- Ultra-fast body diode
- Very low FOM $R_{DS(on)} \times Q_g$
- 100% avalanche tested
- RoHS compliant

APPLICATIONS

- Switch Mode Power Supply (SMPS)
- Uninterruptible Power Supply (UPS)
- Power Factor Correction (PFC)



Device Marking and Package Information

Device	Package	Marking
TPW65R044MFD	TO-247	65R044MFD

Key Performance Parameters

Parameter	Value	Unit
$V_{DS} @ T_{j,max}$	650	V
$R_{DS(on),max}$	0.044	Ω
I_D	72	A
$Q_{g,typ}$	165	nC
I_{DM}	216	A
t_{rr}	242	ns
Q_{rr}	1.5	μC
I_{rrm}	12	A



Absolute Maximum Ratings $T_C = 25^{\circ}\text{C}$, unless otherwise noted				
Parameter		Symbol	Value	Unit
Drain-Source Voltage ($V_{GS} = 0V$)		V_{DSS}	650	V
Continuous Drain Current	$T_C = 25^{\circ}\text{C}$	I_D	72	A
	$T_C = 100^{\circ}\text{C}$		43.2	
Pulsed Drain Current (note1)		I_{DM}	216	A
Gate-Source Voltage		V_{GSS}	± 30	V
Single Pulse Avalanche Energy (note2)		E_{AS}	2185	mJ
Repetitive Avalanche Energy (note2)		E_{AR}	3.31	mJ
Avalanche Current		I_{AR}	13.7	A
MOSFET dv/dt ruggedness, $V_{DS} = 0 \dots 480V$		dv/dt	50	V/ns
Power Dissipation		P_D	500	W
Continuous Body Diode Current		I_S	61	A
Pulsed Diode Forward Current (note1)		I_{SM}	216	
Reverse diode dv/dt (note3)		dv/dt	50	V/ns
Maximum diode commutation speed (note3)		di_f/dt	900	A/us
Operating Junction and Storage Temperature Range		T_J, T_{stg}	-55~+150	$^{\circ}\text{C}$

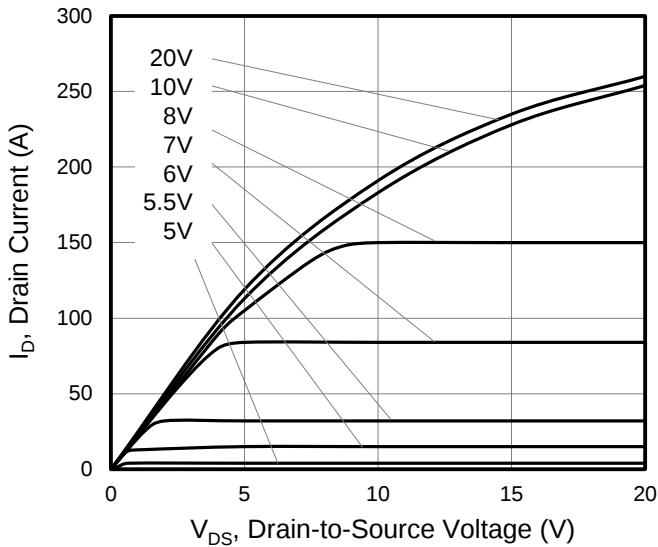
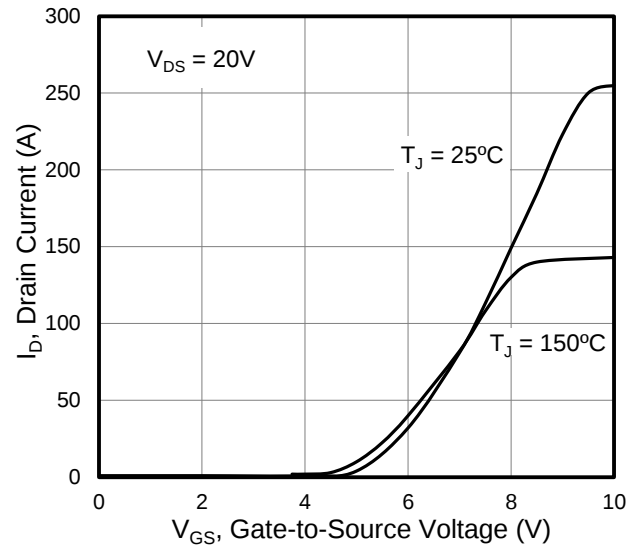
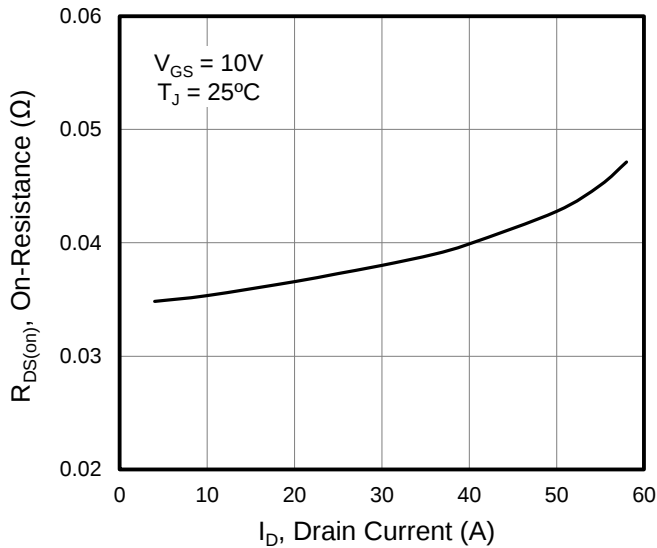
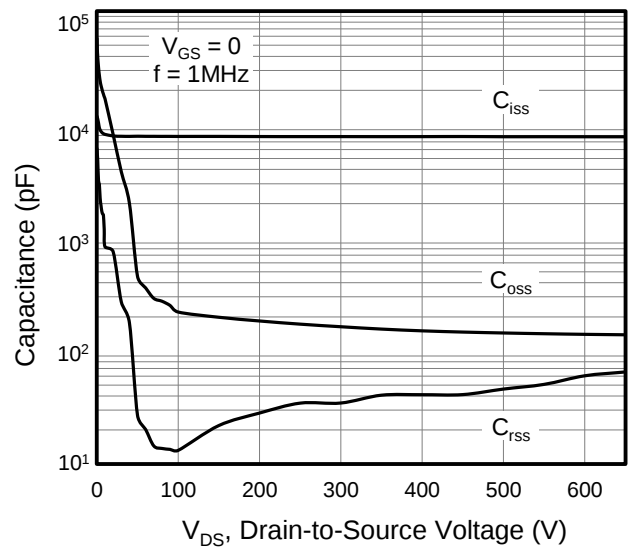
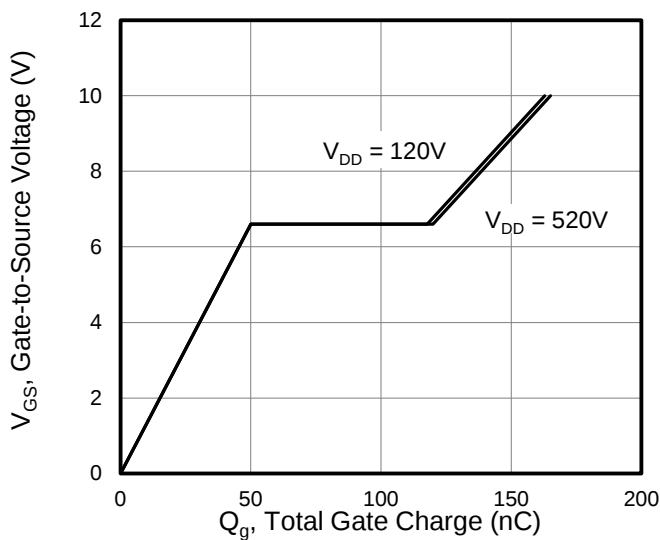
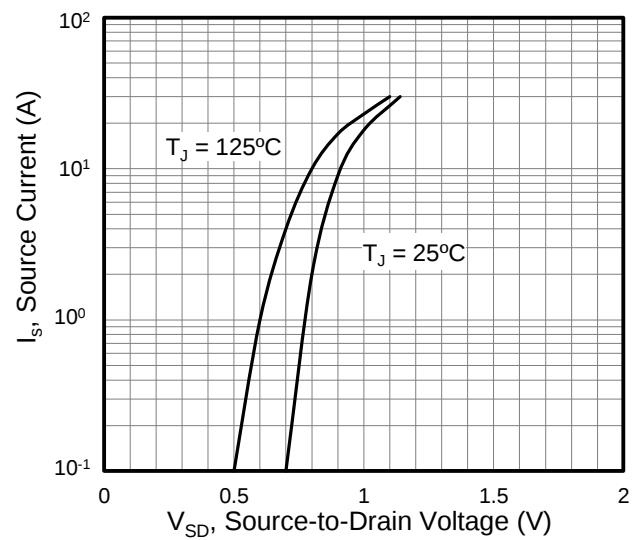
Thermal Resistance			
Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case	R_{thJC}	0.25	$^\circ\text{C/W}$
Thermal Resistance, Junction-to-Ambient	R_{thJA}	62	



Specifications T _J = 25°C, unless otherwise noted						
Parameter	Symbol	Test Conditions	Value			Unit
			Min.	Typ.	Max.	
Static						
Drain-Source Breakdown Voltage	V _{(BR)DSS}	V _{GS} = 0V, I _D = 250μA	650	--	--	V
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} = 650V, V _{GS} = 0V, T _J = 25°C	--	--	10	μA
		V _{DS} = 650V, V _{GS} = 0V, T _J = 150°C	--	--	10000	
Gate-Source Leakage	I _{GSS}	V _{GS} = ±30V	--	--	±100	nA
Gate-Source Threshold Voltage	V _{GS(th)}	V _{DS} = V _{GS} , I _D = 250μA	3	--	5	V
Drain-Source On-Resistance	R _{DS(on)}	V _{GS} = 10V, I _D = 36A	--	0.039	0.044	Ω
Gate resistance	R _G	f = 1.0MHz open drain	--	0.3	--	Ω
Dynamic						
Input Capacitance	C _{iss}	V _{GS} = 0V, V _{DS} = 100V, f = 1.0MHz	--	7837	--	pF
Output Capacitance	C _{oss}		--	221	--	
Reverse Transfer Capacitance	C _{rss}		--	13.2	--	
Total Gate Charge	Q _g	V _{DD} = 520V, I _D = 50A, V _{GS} = 10V	--	165	--	nC
Gate-Source Charge	Q _{gs}		--	50	--	
Gate-Drain Charge	Q _{gd}		--	70	--	
Turn-on Delay Time	t _{d(on)}	V _{DD} = 400V, I _D = 50A, R _G = 25Ω	--	103	--	ns
Turn-on Rise Time	t _r		--	83	--	
Turn-off Delay Time	t _{d(off)}		--	543	--	
Turn-off Fall Time	t _f		--	93	--	
Drain-Source Body Diode Characteristics						
Body Diode Voltage	V _{SD}	T _J = 25°C, I _{SD} = 36A, V _{GS} = 0V	--	1.0	1.5	V
Reverse Recovery Time	t _{rr}	V _R = 400V, I _F = 36A, di _F /dt = 100A/μs	--	242	--	ns
Reverse Recovery Charge	Q _{rr}		--	1.45	--	μC
Peak Reverse Recovery Current	I _{rrm}		--	12	--	A

Notes

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. $I_{AS} = 13.7A, V_{DD} = 50V, R_G = 25\Omega$, Starting $T_J = 25^{\circ}\text{C}$
3. Identical low side and high side switch with identical R_G

**Typical Characteristics** $T_J = 25^\circ\text{C}$, unless otherwise noted**Figure 1. Output Characteristics****Figure 2. Transfer Characteristics****Figure 3. On-Resistance vs. Drain Current****Figure 4. Capacitance****Figure 5. Gate Charge****Figure 6. Body Diode Forward Voltage**

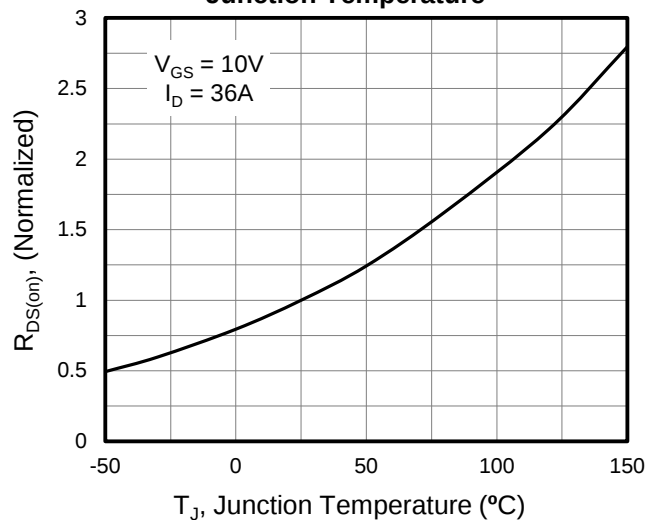
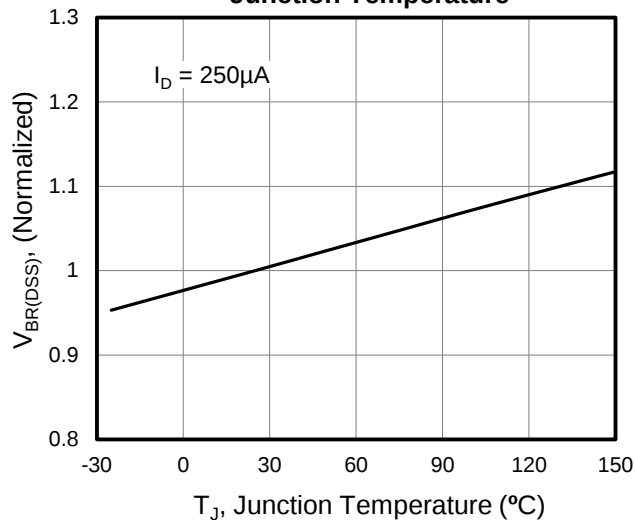
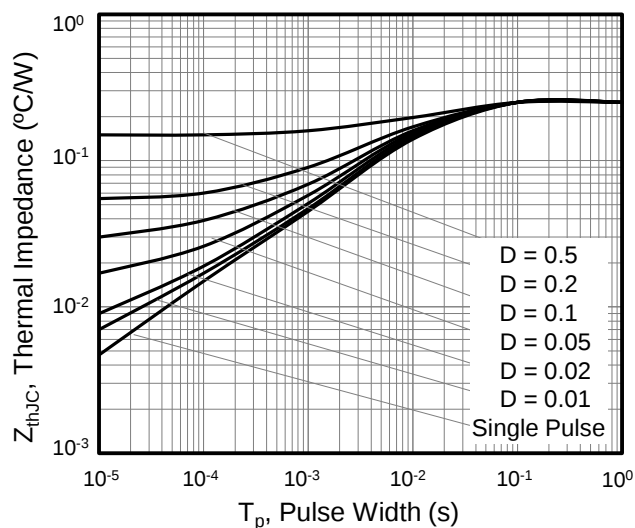
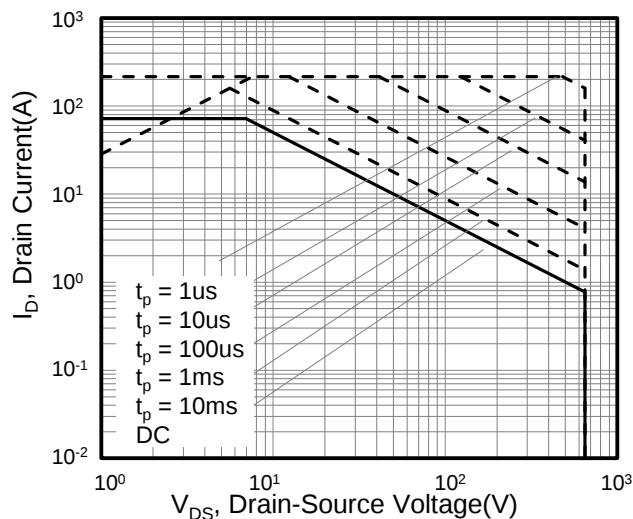
**Typical Characteristics** $T_J = 25^\circ\text{C}$, unless otherwise noted**Figure 7. On-Resistance vs. Junction Temperature****Figure 8. Breakdown voltage vs. Junction Temperature****Figure 9. Transient Thermal Impedance for TO-247****Figure 10. Safe operation area for TO-247**



Figure A: Gate Charge Test Circuit and Waveform

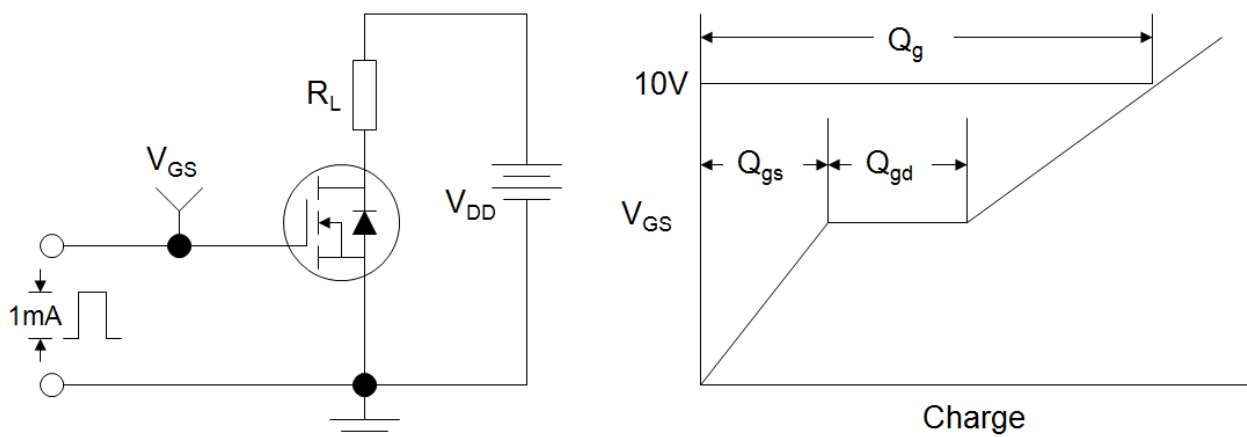


Figure B: Resistive Switching Test Circuit and Waveform

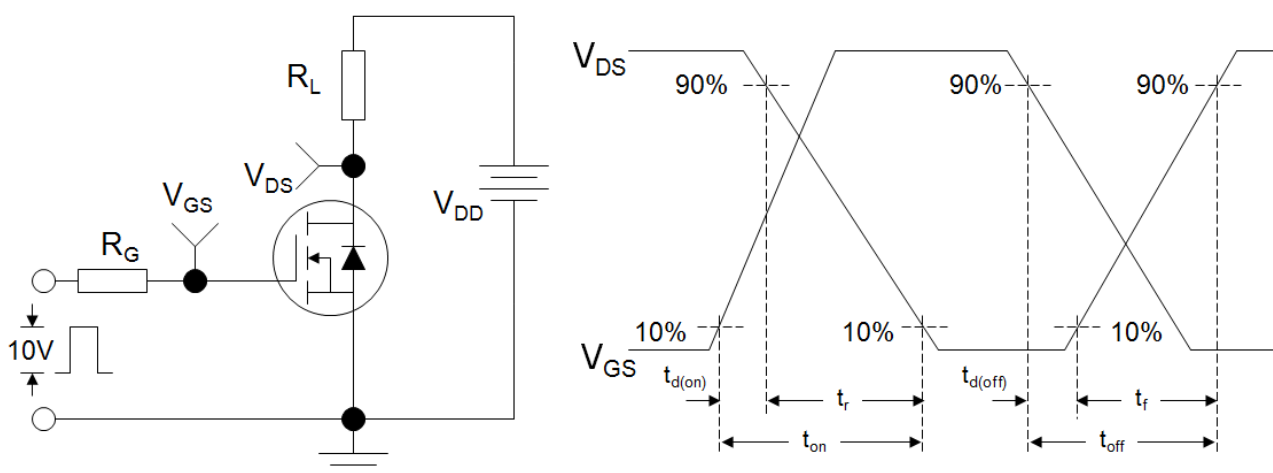
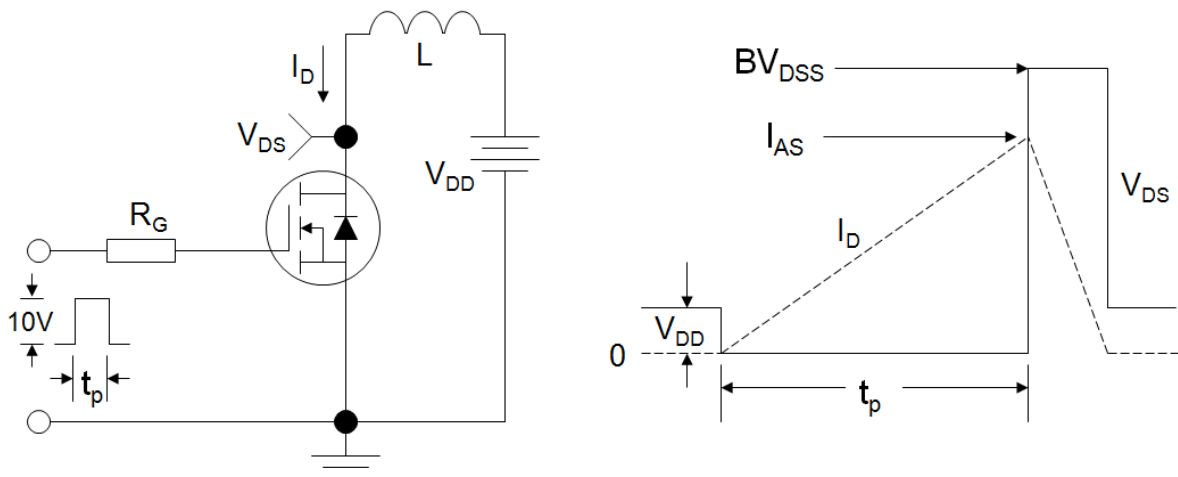
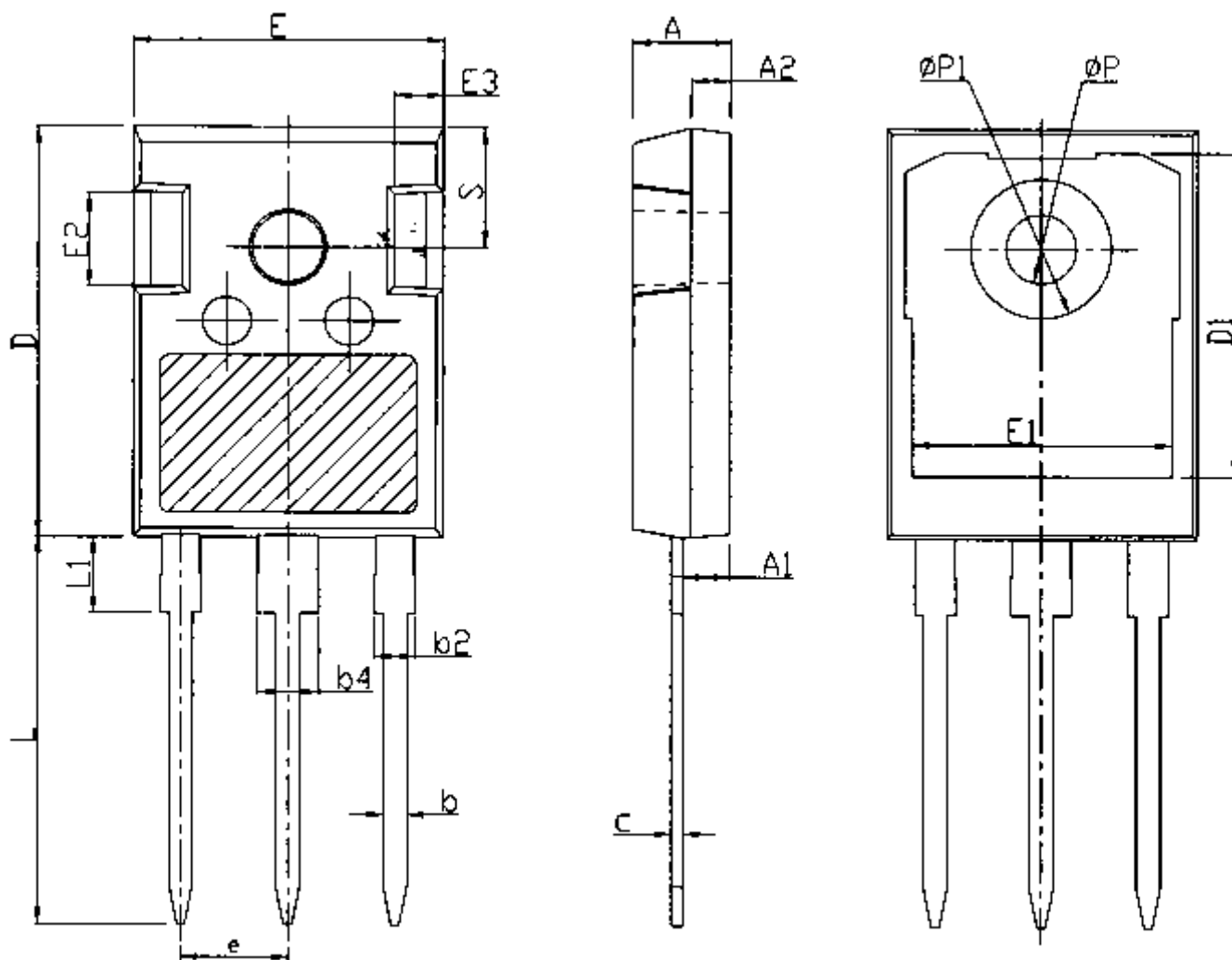


Figure C: Unclamped Inductive Switching Test Circuit and Waveform





TO-247



Unit:mm			
Symbol	Min.	Nom	Max.
A	4.80	5.00	5.20
A1	2.21	2.41	2.61
A2	1.85	2.00	2.15
b	1.11	1.21	1.36
b2	1.91	2.01	2.21
b4	2.91	3.01	3.21
c	0.51	0.61	0.75
D	20.70	21.00	21.30
D1	16.25	16.55	16.85

Unit:mm			
Symbol	Min.	Nom.	Max.
E	15.50	15.80	16.10
E1	13.00	13.30	13.60
E2	4.80	5.00	5.20
E3	2.30	2.50	2.70
e	5.44BSC		
L	19.62	19.92	20.22
L1	-	-	4.30
ϕP	3.40	3.60	3.80
$\phi P1$	-	-	7.30
S	6.15BSC		



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